Session 3B: Stress Testing from Macro-environment, to Scenario to Impacts and Decision

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Moody's Analytics

ERM Symposium - Stress Testing: from Macro-environment, to Scenario, to Impacts and Decisions

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2017

Agenda

- What is Stress Testing?
- Where Would I get Stress Testing Scenarios? Examples
- Creating Scenarios: Macroeconomic and Market variables
- Assessing Frequency and Severity

What is Stress Testing?

Stress testing of financial institutions is designed to gauge the impact of changing financial situations on the balance sheet.

Broadly speaking there are 3 types of stress test:

1. **Sensitivity Test** – typically smaller changes to a single variable (often instantaneous)
2. **Scenario Test** – would usually involve simultaneous changes to a number of variables, possibly to emulate a possible future state of the economy.
3. **Reverse Stress Test** – this type of stress testing tries to identify the situation(s) where the financial institution would fail (insolvency, breach risk appetite etc.).

Where would I get Stress Testing Scenarios?

Sources:

1. Business Plan (Finance Department)
2. Historical – what if 2008 happened again?
3. Economists - Internal/External Research and Forecasting
4. Regulatory (Prescribed):
    1. CCAR (FED - Comprehensive Capital Analysis and Review)
    2. ORSA annually over the business plan horizon and different stress scenarios

Considerations:

5. Applicability
6. Data Availability
7. Understandability: Results discussed by the board

Example Stress Testing Scenarios

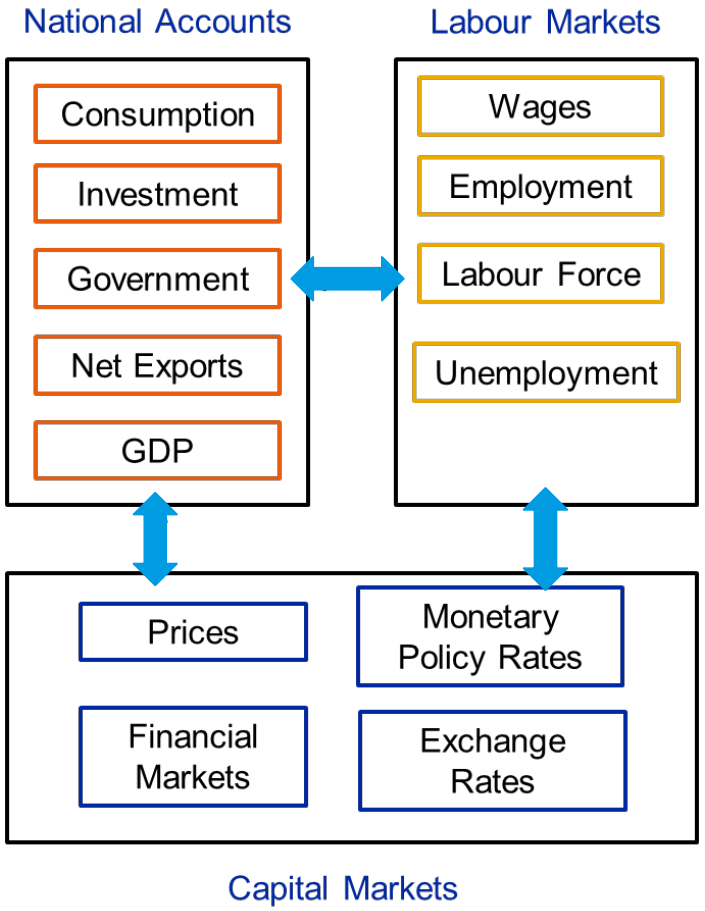
1. CCAR - Baseline, Adverse, and Severely Adverse
2. Slower Near Term Growth – bad Brexit, strong dollar, less exports
3. Stronger Near Term Growth – better Brexit, stronger EU, more exports
4. Moderate recession – Brexit contagion, EU recession
5. Protracted Slump
6. Below Trend Long Term Growth
7. Stagflation - persistent high inflation combined with high unemployment and stagnant demand in a country's economy.
8. Next Cycle Recession
9. Low Oil Price
10. Baseline

Ref 2: Moody's Analytics Forecasts with Alternative Scenarios (August 2016 Views)

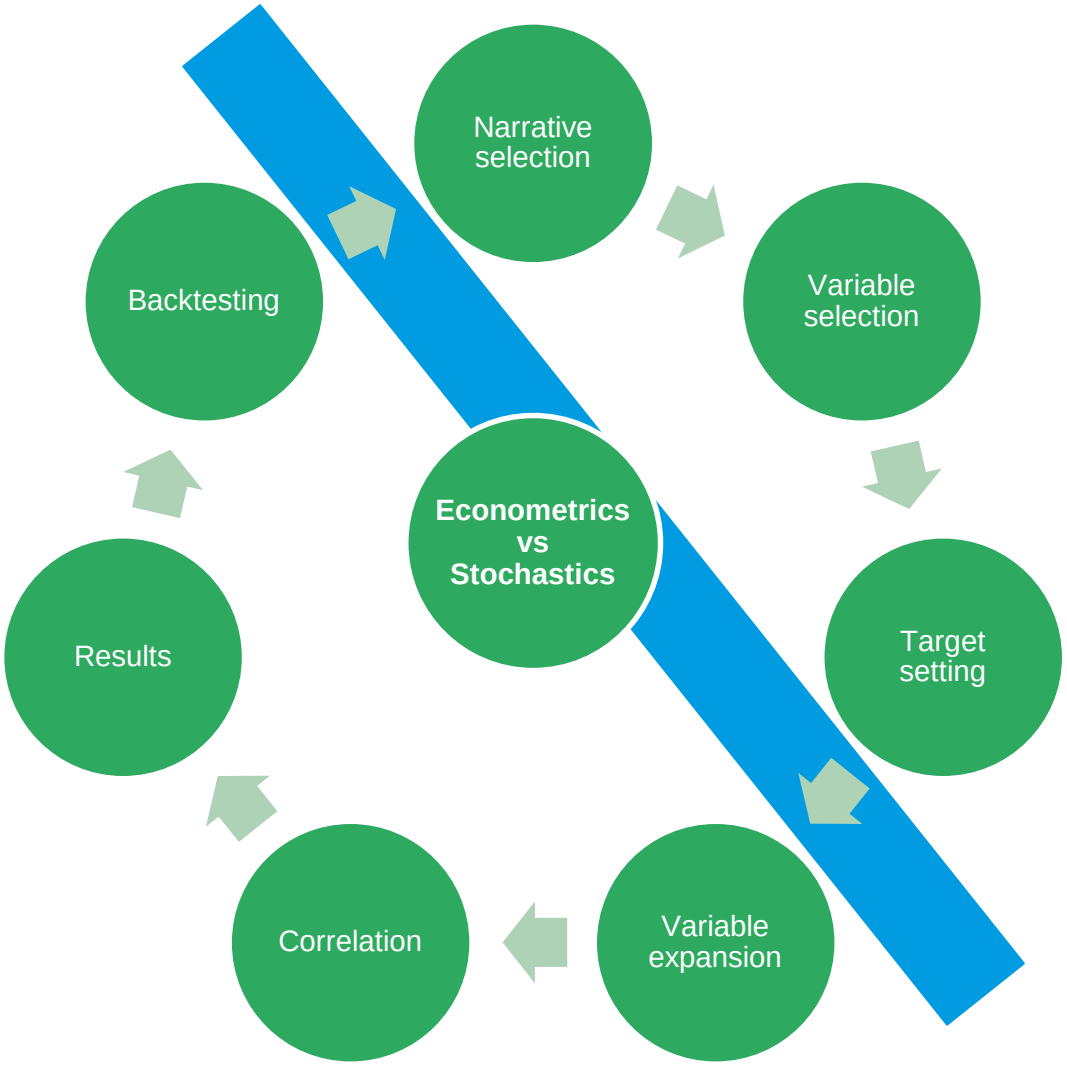
Oftentimes stress scenarios include a mix of both financial and macroeconomic variables

Linkage Between Macroeconomic and Financial Variables

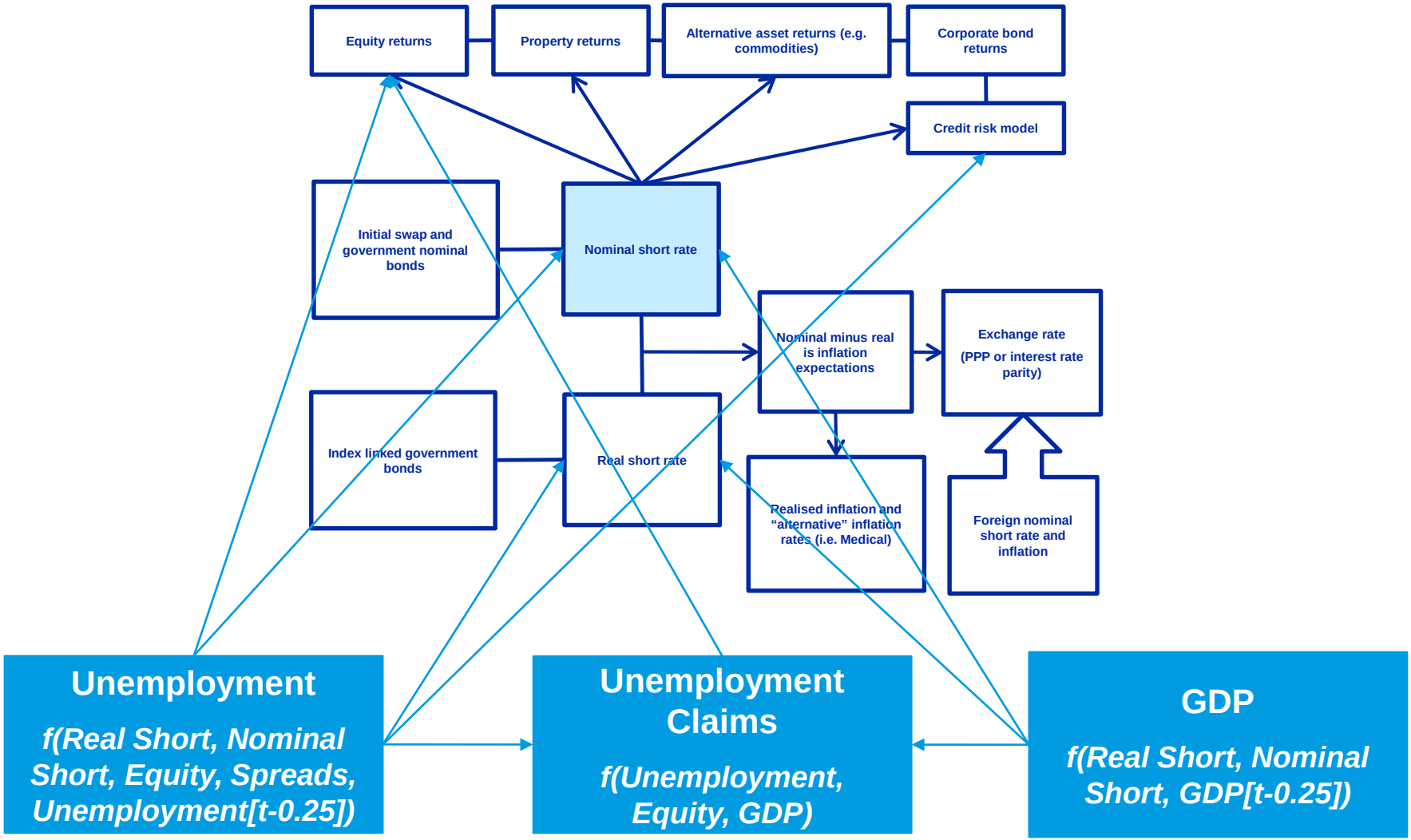
- Capital markets are an objective barometer / driver of macroeconomic conditions.
- Trading prices of financial products signal expectations for the future state of the economy.



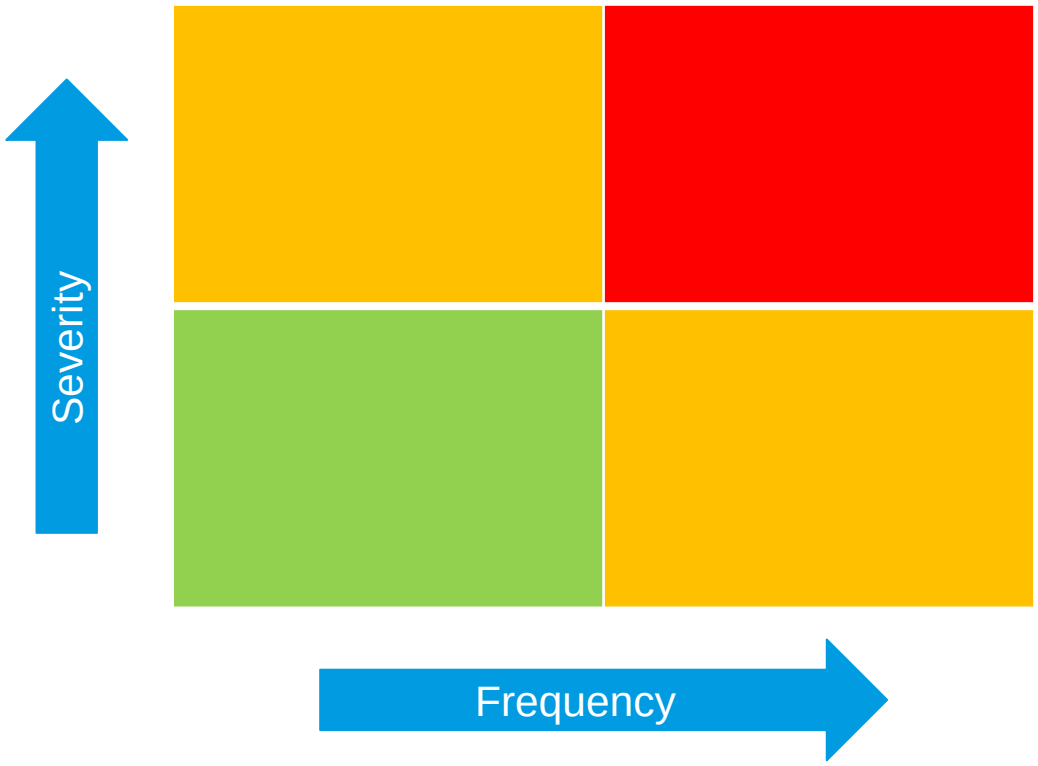
The roles of Economists and Actuaries



Market/Macroeconomic Variable Framework



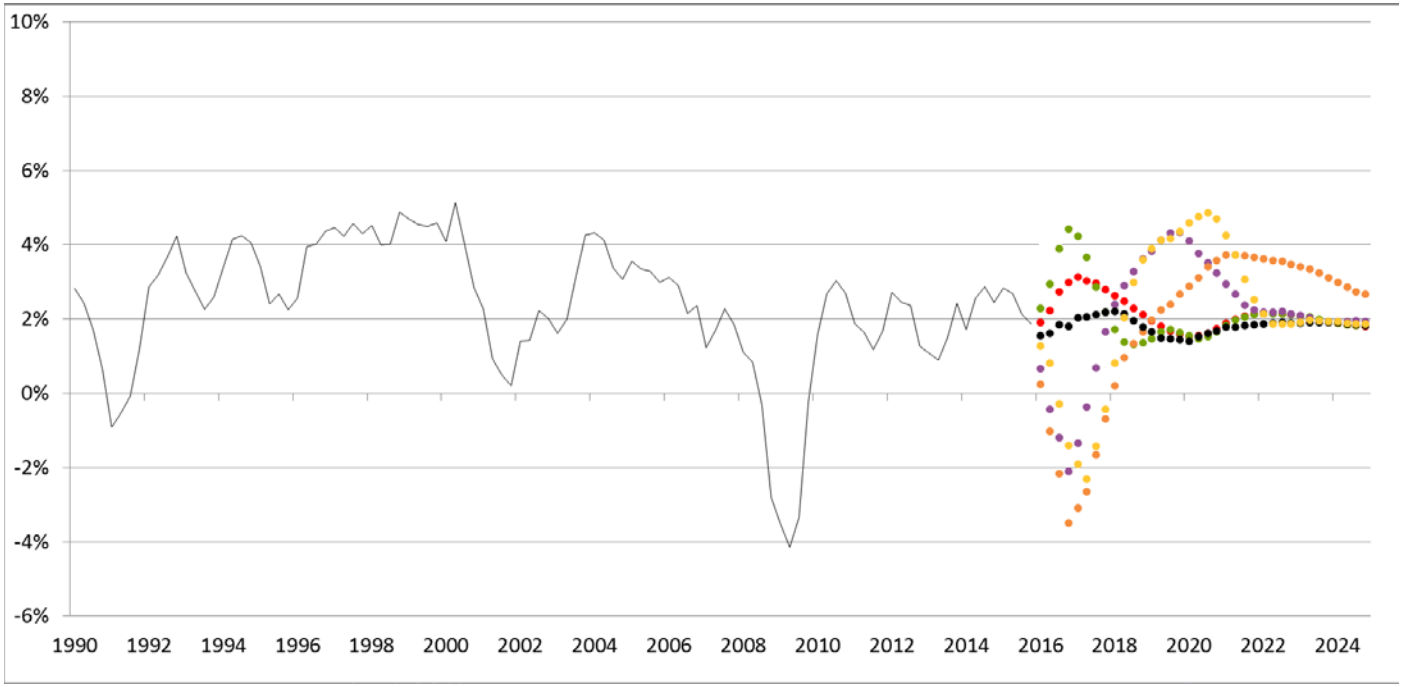
Frequency and Severity



Macroeconomic Forecasting Example GDP

» Based on econometric modelling

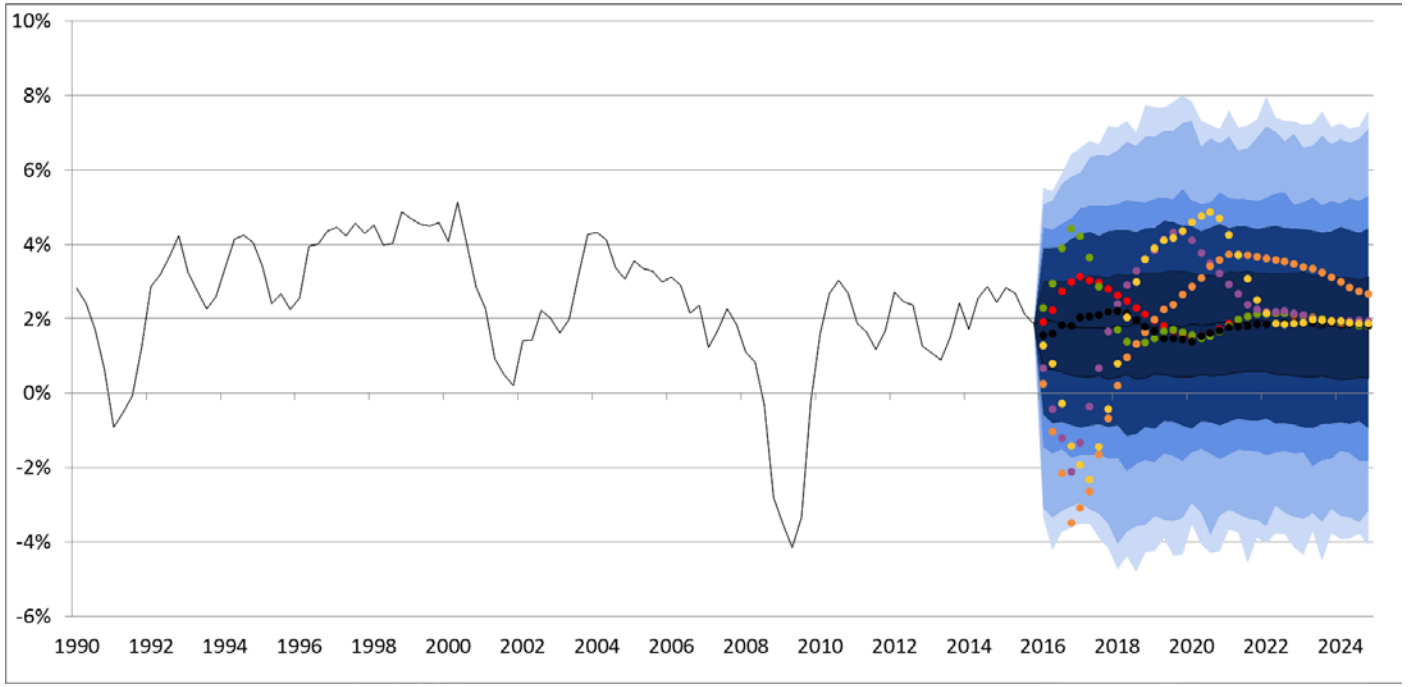
Gross Domestic Product Growth distribution



Accessing Frequency

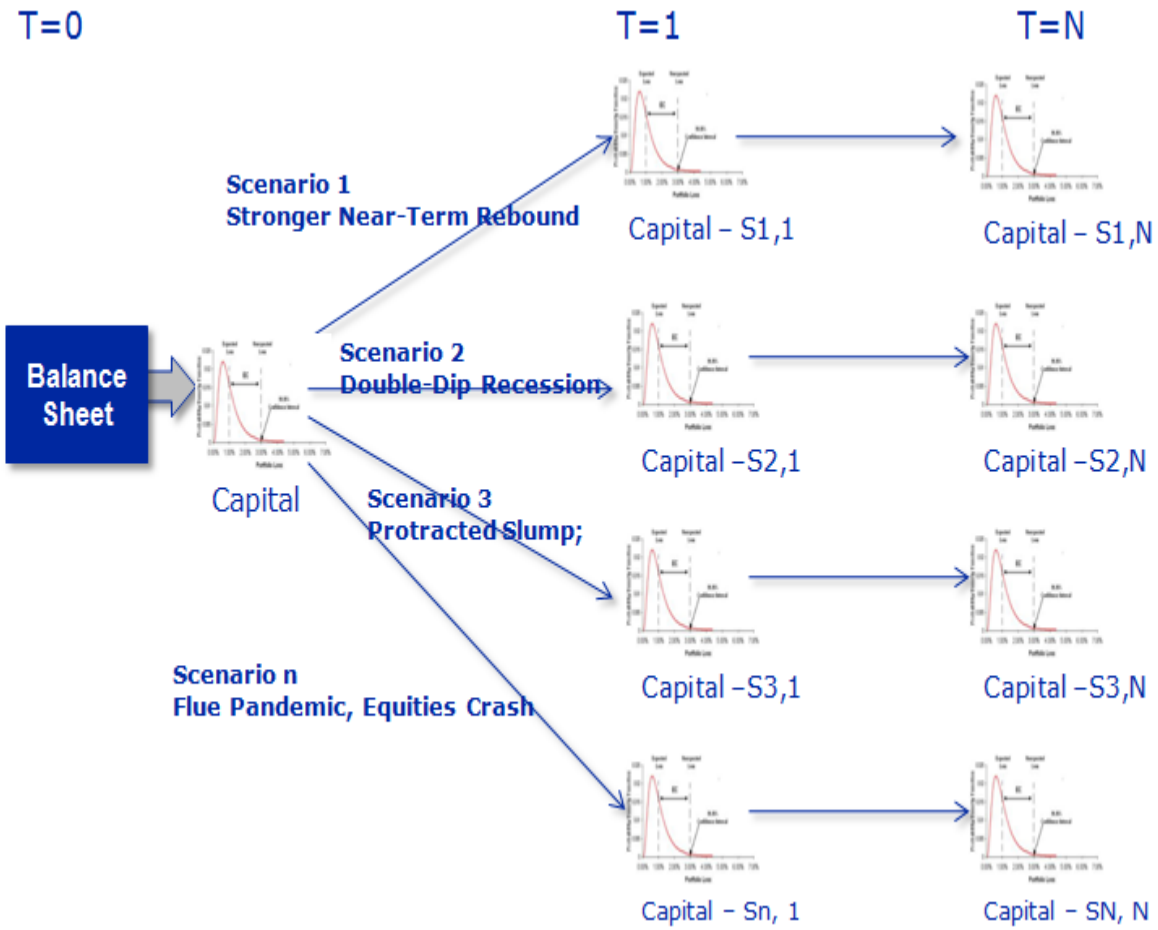
» Econometric forecasts overlaid with stochastic distribution

Gross Domestic Product Growth distribution



Accessing Severity
Capital & Solvency Projection

- Forward looking analysis of solvency & capital requirements.
- Potentially complex depending on the nature of assets and liabilities
- Data and calculation intensive nxN more than the initial solvency calculation.
- Significant expert input – scenarios, calibration, approximation methods etc

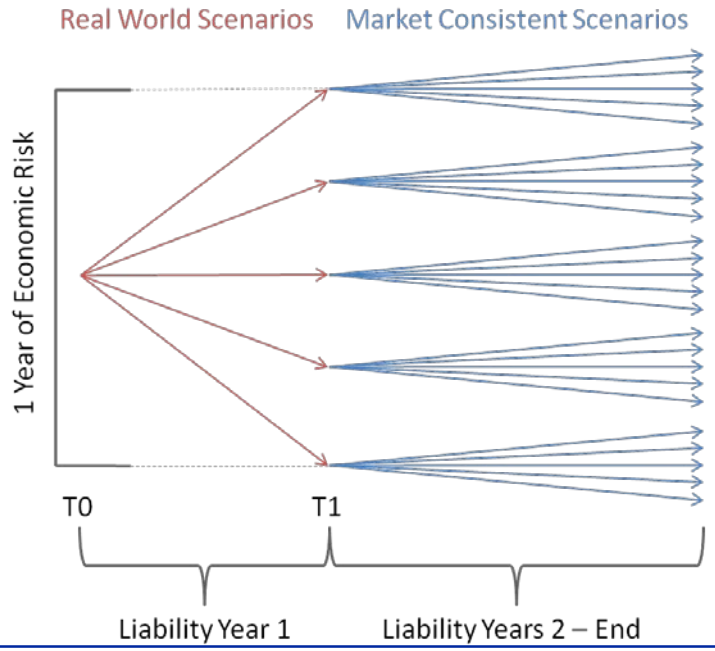


Accessing Severity
Calculating solvency capital along the path

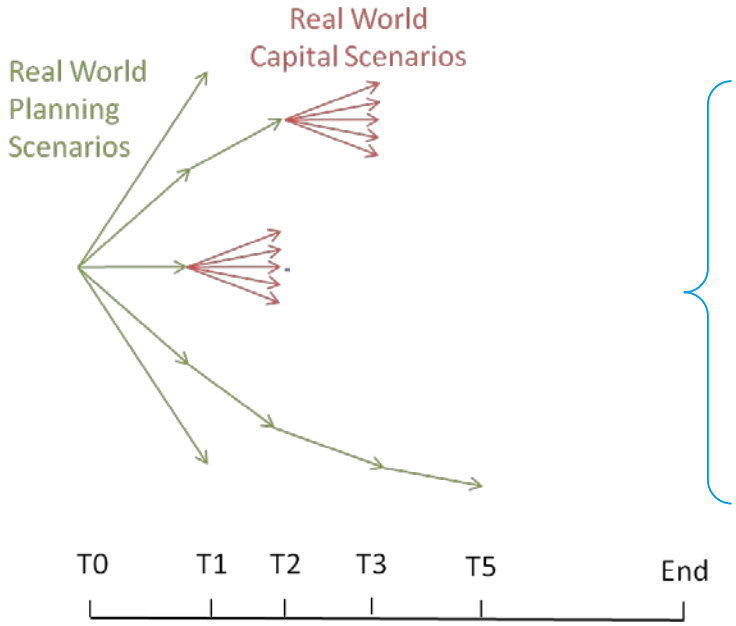
- U.S statutory reserving and capital often prescribes a CTE calculation approach
- Proxy techniques such as curve fitting and LSMC can prove useful

» Stochastic real world scenarios with deterministic root behaving similarly to risk neutral / real world nested stochastic

Capital calculation



Multi timestep capital projection



Ref 3: Moody's Analytics: Proxy Methods for Run-off CTE Capital Projection, October 2016

References

Reference 1: IAA Stress Testing and Scenario Analysis, July 2013

http://www.actuaries.org/CTTEES_SOLV/Documents/StressTestingPaper.pdf

Reference 2: Moody Analytics Forecasts with Alternative Scenarios, August 2016

https://www.economy.com/products/alternative-scenarios

Reference 3: Proxy Methods for Run-off CTE Capital Projection, October 2016

http://www.moodysanalytics.com/~/media/Insight/2017/proxy-methods-for-run-off-cte-capital-projection-life-insurance-case-study.pdf

Integrated stress testing and forecasting

ERM Symposium — April 20, 2017

David Wicklund, FSA, CFA

EY
Building a better working world

Agenda

- Stress testing and forecasting
- Developing an approach
  - Inputs
  - Calculations
  - Consolidation
  - Outputs
  - Uses
- Takeaways

Stress testing and forecasting
Industry current state

Financial forecast

Focus: earnings

Scenarios: baseline (limited or no stresses)

Uses: financial planning and analysis

Process owner: finance

Stress testing

Focus: solvency

Scenarios: deterministic stresses

Uses: risk management and/or regulatory (e.g., ORSA)

Process owner: risk management or actuarial

Current state shortcomings

Process:

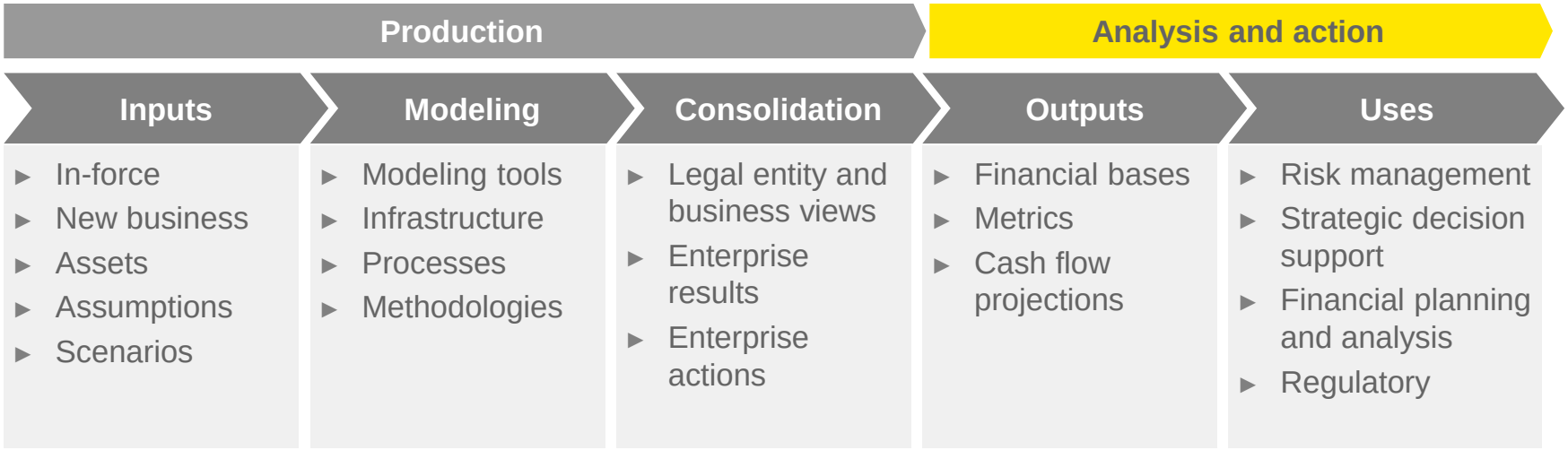
- Redundancy and inconsistency between forecast and stress testing
- Inefficient and manual processes
- Long cycle times

Use:

- Narrow scope
- Limited flexibility and ability to inform management decisions
- Limited reflection of legal entity and holding company dynamics

Stress testing and forecasting

Integrated approach — potential future state



Integrated approach benefits

Process:

- Consistency across uses
- Increased efficiency
- Generate comprehensive view (GAAP, stat, etc.) in one process

Use:

- Ability to connect with risk appetite across multiple lenses
- Better information to drive management decisions

Developing an approach
Inputs

Scenarios	▸ Deterministic “outer loop” scenarios ▸ “Inner loop” scenarios ▸ Risk drivers
Assumptions	▸ Inner loop vs. outer loop assumptions ▸ Assumption unlocking in stress scenarios
New business	▸ New business inclusion ▸ Number of years of new business ▸ Volumes and pricing under stress

Developing an approach
Modeling

Actuarial or finance-driven

- Process ownership
- Business unit results consolidation
- Supporting infrastructure

Description

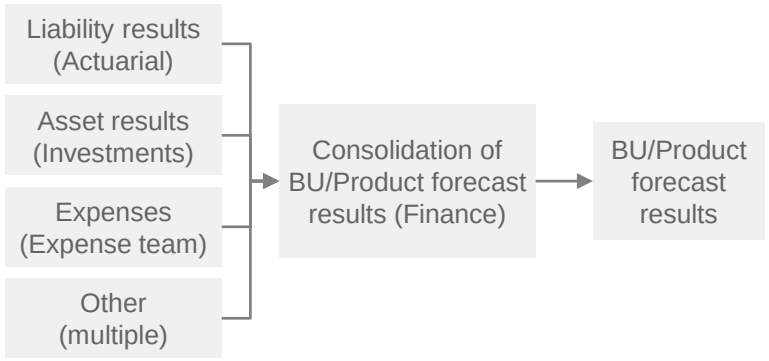
Finance-driven approach

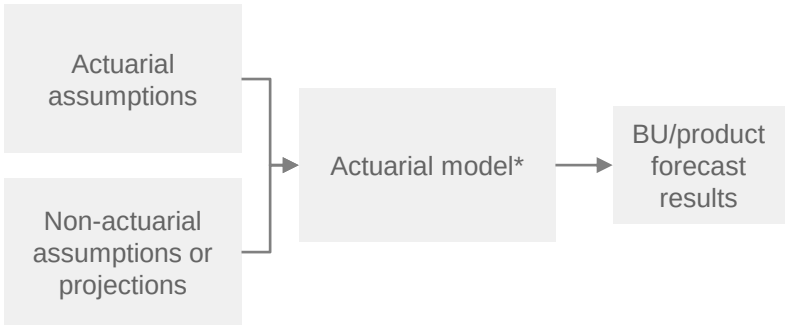
- Finance-led process
- Finance forecasting team combines results provided by business partners (e.g., actuarial, investments, expenses, tax) to complete the forecast

Actuarial-driven approach

- Actuarial led process
- Forecasting components (e.g., assets, liabilities, expenses) are modeled together in an actuarial modeling process

Process illustration





* May include external asset projections.

Developing an approach
Modeling

Asset and liability interaction

- Reinvestments and divestitures
- Asset-dependent liabilities
- Asset system vs. actuarial system

Asset modeling system — **Actuarial modeling system**

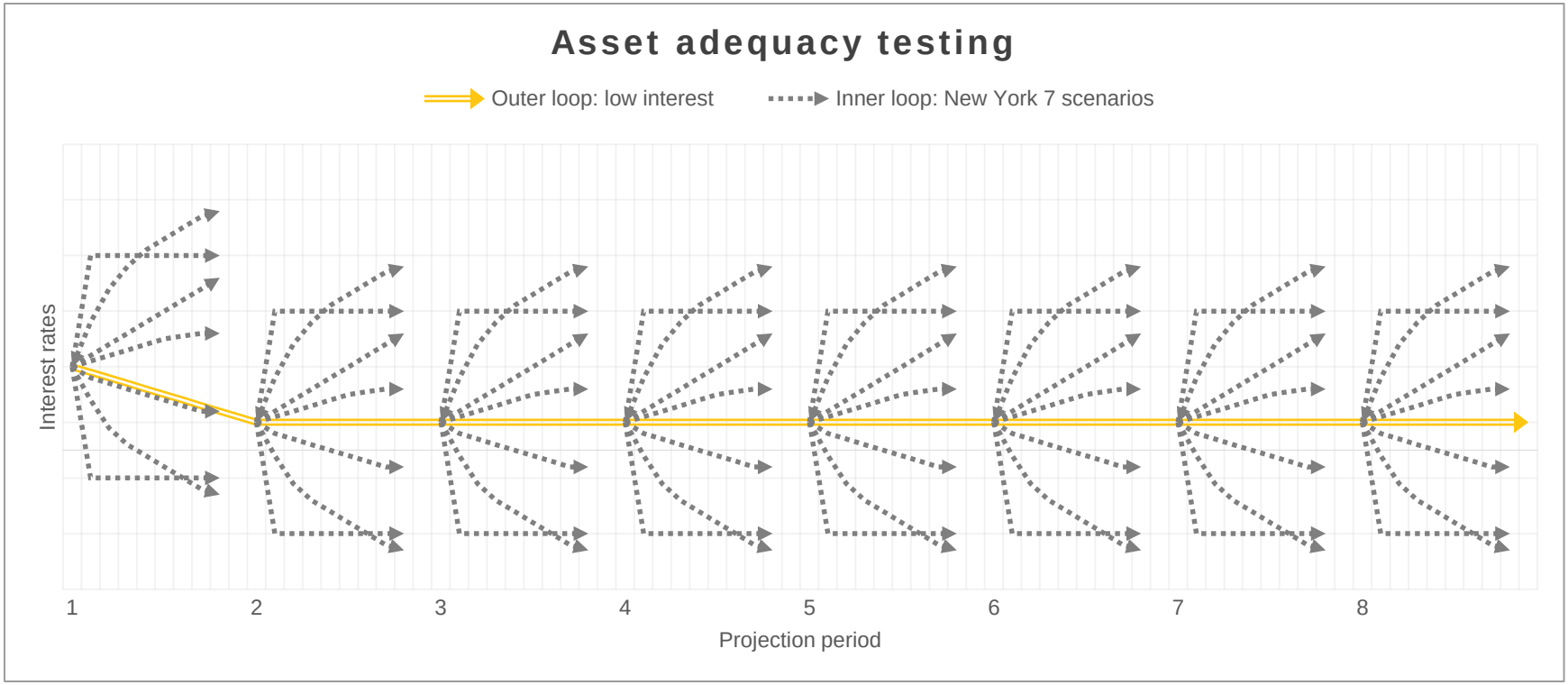
Asset system: ▸ Existing assets ▸ Reinvestments ▸ Liabilities **Liability system:** ▸ N/A	**Asset system:** ▸ Existing assets ▸ Reinvestments **Liability system:** ▸ Liabilities	**Asset system:** ▸ Existing assets **Liability system:** ▸ Liabilities ▸ Reinvestments	**Asset system:** ▸ N/A **Liability system:** ▸ Existing assets ▸ Reinvestments ▸ Liabilities

Preferred approaches to capture asset and liability complexities

Developing an approach
Modeling

Complex actuarial balances

- Projecting VA reserves, AAT reserves, DAC unlocking, etc.
- Outer and inner loops
- First principles vs. driver-based approaches



Developing an approach
Consolidation

Aggregation	► Legal entities: insurance, holding company and other ► Business unit and/or product line ► Enterprise view
Enterprise actions (external)	► Dividends and share repurchases ► Debt issuance ► Contingent capital/liquidity actions
Enterprise actions (affiliated)	► Holding company and legal entity dynamics ► Capital management/transfers (dividends, injections, etc.) ► Internal borrowing and guarantees

Developing an approach
Outputs

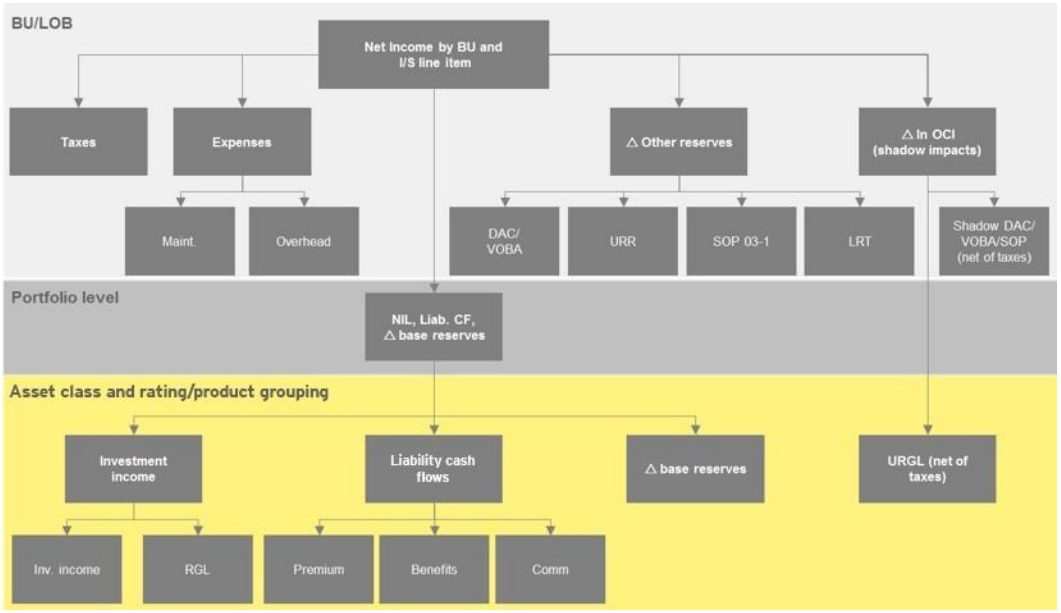
Reporting and analytics

- Financial bases: GAAP, statutory, cash flow, economic
- Projection horizon and time-steps
- Risk and return metrics
- Drill-down capabilities

Potential outputs

Statutory financials	GAAP financials
RBC and other capital ratios	Cash flow statements
Internal economic	Other performance metrics
Leverage metrics	Liquidity metrics

Illustrative GAAP earnings drill-down



Developing an approach
Uses

Risk management	▸ Stress testing as an outcomes-based risk appetite lens ▸ Multiple bases: GAAP, statutory (RBC), liquidity ▸ Multiple severities
Strategic decision support	▸ What-if analysis of potential management actions ▸ Asset mix, product mix, capital actions, new business, etc. ▸ Impact on multiple frameworks/metrics in baseline and stress
Financial planning	▸ Capital planning ▸ Budgeting ▸ Earnings guidance
Regulatory	▸ ORSA ▸ SIFI or GSII requirements

Takeaways

- ***Integration*** — there is an opportunity to integrate forecasting and stress testing into one process.
- ***Efficiency*** — further efficiency can be gained through process redesign and/or improvement.
- ***Expanded use*** — a more robust forecasting and stress testing process can support risk appetite and strategic decisions.
- ***No one-size-fits-all approach*** — an effective stress testing approach can be achieved through varying processes, models and methodologies; it should be designed with the organization's characteristics and planned uses in mind.

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